

WHAT IS CLAIMED IS:

1. An apparatus for exchanging heat from a first fluid to a second fluid, the apparatus comprising:
  - 5 a plurality of flow divider sheets positioned in a stacked configuration and extending in a longitudinal direction such that adjacent pairs of the sheets define flow passages therebetween for receiving the first and second fluids, each sheet being nonuniform in the longitudinal direction to define a manifold portion and a corrugated portion, the manifold portions of the adjacent pairs of the sheets defining the flow
  - 10 passages therebetween for receiving the fluids, the corrugated portions of each adjacent pair of sheets defining a plurality of fluid channels therebetween connected to the flow passage defined by the manifold portions of a respective pair of flow divider sheets, the fluid channels extending generally in the longitudinal direction; wherein first and second pluralities of the flow passages are configured to
  - 15 receive a respective one of the first and second fluids, at least some of the fluid passages being structured to provide a flow of the respective fluid at least partially in a direction transverse to the longitudinal direction, and each flow passage being structured to receive the respective fluid in the fluid channels defined by the respective pair of flow divider sheets such that thermal energy is transferred between
  - 20 the fluids flowing between the corrugated portions of the flow divider sheets.
2. An apparatus according to Claim 1 wherein the manifold portions of the flow divider sheets define inlets fluidly connected to the first plurality of flow passages, the inlets being directed transverse to the longitudinal direction of the flow divider sheets.
- 25 3. An apparatus according to Claim 2 further comprising vanes disposed in the first flow passages and structured to direct the flow of the first fluid from a generally transverse direction at the inlets to a generally longitudinal direction at the channels.
- 30 4. An apparatus according to Claim 1 wherein the corrugated portions of adjacent flow divider sheets contact along a plurality of interfaces extending in the longitudinal direction of the sheets, thereby substantially preventing transverse flow of the fluids between adjacent channels of the flow passages.

5. An apparatus according to Claim 1 wherein the corrugated portions of adjacent flow divider sheets are substantially disconnected throughout the corrugated portions of the flow passages such that the adjacent sheets are adjustable during 5 operation of the apparatus.

6. An apparatus according to Claim 1 further comprising a plurality of elongate members disposed between the flow divider sheets and extending in a generally transverse direction, the elongate members structured to maintain a position of the 10 flow divider sheets and thereby maintain the flow passages therebetween.

7. An apparatus according to Claim 1 wherein at least some of the flow divider sheets define a plurality of apertures fluidly connecting the first and second channels of the flow passages such that the first fluid flows through the apertures and 15 comprises at least a part of the second fluid.

8. A catalytic heat exchanger apparatus for delivering a combustible fluid to a combustion device, the apparatus comprising:  
a plurality of flow divider sheets extending in a longitudinal direction and 20 positioned in a stacked configuration such that adjacent pairs of the sheets define flow passages therebetween, each sheet being nonuniform in the longitudinal direction to define a manifold portion and a corrugated portion, the manifold portions of the adjacent pairs of the sheets defining the flow passages therebetween for receiving the fluids, the corrugated portions of each adjacent pair of sheets defining a plurality of 25 fluid channels therebetween and connected to the flow passage defined by the manifold portions of a respective pair of the flow divider sheets, the fluid channels extending generally in the longitudinal direction and being fluidly connected at an end opposite the manifold portions of the sheets;

30 a plurality of inlets defined by a first plurality of the flow passages, the inlets configured to receive an oxidizing fluid and deliver the oxidizing fluid in a first flow direction to the fluid channels of the first plurality of flow passages;

a fuel injector proximate to an end of the corrugated portions of the flow divider sheets, the fuel injector configured to deliver a combustible fluid to the

oxidizing fluid at the end of the fluid channels opposite the manifold portions such that the oxidizing fluid and the combustible fluid mix to form a combustible mixture flowing through the fluid channels of a second plurality of the flow passages in a second flow direction generally opposite the first flow direction; and

5        an outlet defined by the second plurality of the flow passages, the outlet configured to deliver the combustible mixture from the second plurality of the flow passages,

              wherein the first and second pluralities of flow passages thermally communicate such that thermal energy resulting from a combustion of the

10      combustible fluid in the fluid channels of the second plurality of the flow passages is transferred to the oxidizing fluid in the fluid channels of the first plurality of the flow passages, thereby pre-heating the oxidizing fluid before the oxidizing fluid enters the second plurality of the flow passages.

15      9.        An apparatus according to Claim 8 wherein the inlets are configured in a direction transverse to the longitudinal direction of the flow divider sheets such that the oxidizing fluid enters the first flow passages in the transverse direction and is directed to the longitudinal direction of the fluid channels of the first flow passages.

20      10.      An apparatus according to Claim 9 further comprising vanes disposed in the first flow passages and structured to direct the flow of the oxidizing fluid from a generally transverse direction at the inlets to a generally longitudinal direction at the channels.

25      11.      An apparatus according to Claim 8 wherein the corrugated portions of adjacent flow divider sheets contact along a plurality of interfaces extending in the longitudinal direction of the sheets, thereby substantially preventing transverse flow of the fluids in the channels between adjacent channels.

30      12.      An apparatus according to Claim 8 wherein the corrugated portions of adjacent flow divider sheets are substantially disconnected throughout the corrugated portions of the flow passages such that the adjacent sheets are adjustable during operation of the apparatus.

13. An apparatus according to Claim 8 further comprising a plurality of elongate members disposed between the flow divider sheets and extending in a generally transverse direction, the elongate members structured to maintain a position of the 5 flow divider sheets and thereby maintain the flow passages therebetween.

14. An apparatus according to Claim 8 wherein at least some of the flow divider sheets define apertures fluidly connecting the fluid channels of the first and second flow passages.

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15. An apparatus according to Claim 8 further comprising a second fuel injector proximate to the outlet of the second plurality of the flow passages, the second fuel injector configured to transmit the combustible mixture therethrough and deliver additional combustible fluid to the combustible mixture.

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16. An apparatus according to Claim 8 further comprising a catalyst disposed on surfaces of the flow divider sheets defining the second plurality of the flow passages.

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17. An apparatus according to Claim 8 further comprising a plurality of corrugated inserts disposed in the second plurality of the flow passages, each corrugated insert having a catalyst disposed on at least one surface thereof.

18. A heat exchanger apparatus for exchanging heat between first and second fluids therein, the apparatus comprising:

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a plurality of flow divider sheets positioned in a stacked configuration and extending in a longitudinal direction such that adjacent pairs of the sheets define flow passages therebetween for receiving the first and second fluids, each sheet being nonuniform in the longitudinal direction to define first and second manifold portions longitudinally opposite a corrugated portion, such that each flow passage includes 30 first and second manifold portions and a plurality of fluid channels extending longitudinally therebetween,

wherein a first plurality of the flow passages are configured to receive the first fluid and a second plurality of the flow passages are configured to receive the second

fluid, each flow passage being structured to receive the respective fluid in the fluid channels such that thermal energy is transferred between the fluids flowing between the corrugated portions of the flow divider sheets.

- 5 19. An apparatus according to Claim 18 wherein each of the first and second manifold portions of the flow divider sheets defines two ports for substantially separately communicating the first and second fluids.
- 10 20. An apparatus according to Claim 19 wherein one of the ports defined by each of the first and second manifold portions is a transverse port configured in a direction transverse to the longitudinal direction of the flow divider sheets such that fluid flowing through the transverse port flows at least partially in the transverse direction between the transverse port and the fluid channels.
- 15 21. An apparatus according to Claim 20 further comprising vanes disposed in the flow passages and structured to direct a fluid flow of the fluid between a transverse direction of the transverse port and the longitudinal direction of the fluid channels.
- 20 22. An apparatus according to Claim 18 wherein the corrugated portions of adjacent flow divider sheets contact along a plurality of interfaces extending in the longitudinal direction of the sheets, thereby substantially preventing transverse flow of the fluids in the channels between adjacent channels.
- 25 23. An apparatus according to Claim 18 wherein the corrugated portions of adjacent flow divider sheets are substantially disconnected throughout the corrugated portions of the flow passages such that the adjacent sheets are adjustable during operation of the apparatus.
- 30 24. An apparatus according to Claim 18 further comprising a plurality of elongate members disposed between the flow divider sheets and extending in a generally transverse direction, the elongate members structured to maintain a position of the flow divider sheets and thereby maintain the flow passages therebetween.